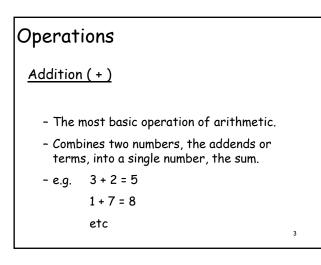
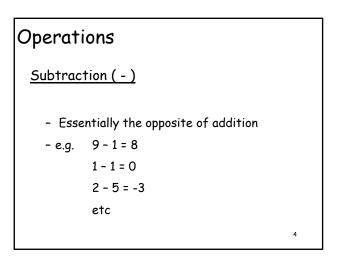
PAM1014 Introduction to Radiation Physics

"Operations & Equations"

In this Lecture

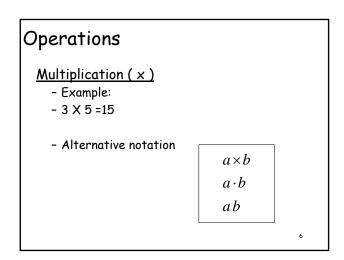
- Introduce
 - Operations
 - -Powers
 - -Roots
 - Reciprocals
 - Solving Equations

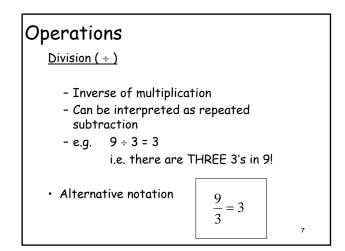




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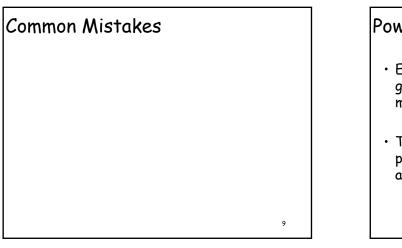
Operations Multiplication (x) - Can be interpreted as repeated addition - e.g. 7 × 3 = 21 7 + 7 + 7 = 21 2.1 × 3 = 6.3 2.1 + 2.1 + 2.1 = 6.3 etc





Operations

• Things worth remembering: $(a \times b) \times c = a \times (b \times c) = b \times (a \times c) = a \times b \times c$ $(a + b) \times c = (a \times c) + (b \times c)$ $(ab + cb) = (a + c) \times b$ $(+) \times (-) = (-)$ $(-) \times (-) = (+)$ $(+) \div (-) = (-)$ $(-) \div (+) = (-)$ $(-) \div (-) = (+)$



Powers

- Exponentiation (or Powers) is a process generalized from repeated (or iterated) multiplication.
- The same way that multiplication is a process generalized from repeated addition.

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Powers

Positive integer exponents

• Indicates repeated multiplication by the base

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• Examples:

 $3^5=3\times3\times3\times3\times3\times3=243$

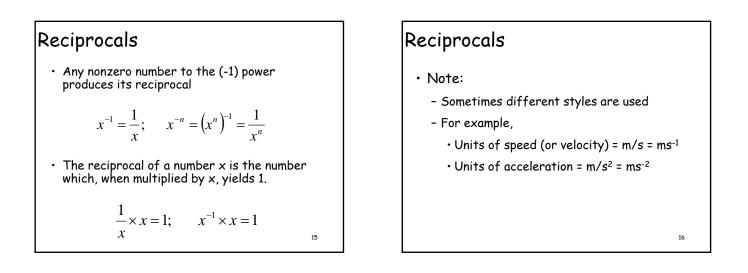
- \cdot 3 is the base
- \cdot 5 is the exponent

Examples $2^{3} =$ $3^{3} =$ $5^{2} =$ $10^{3} =$ $10^{9} =$ 12^{2}

Powers
Negative integer exponents
• Indicates repeated division by the base
• Example

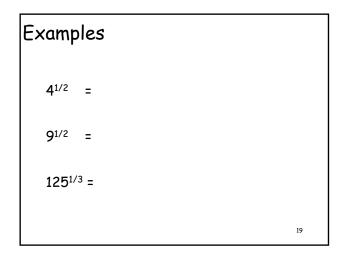
$$3^{-5} = \frac{1}{3 \times 3 \times 3 \times 3} = \frac{1}{243}$$

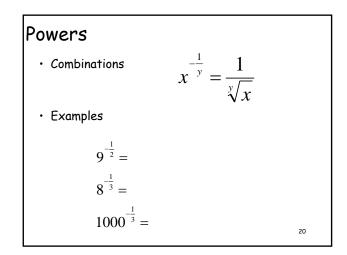
Examples	
2-1 =	
2-3 =	
5 ⁻² =	
10 ⁻³ =	
10 ⁻⁹ =	14

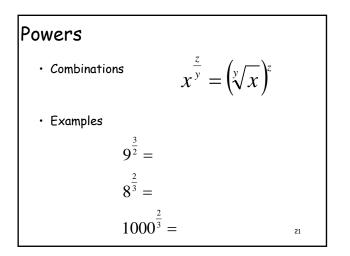


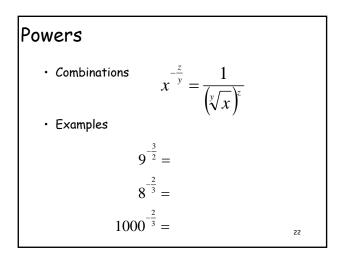
Roots
• Square root (J)
If
$$r^2 = x$$
; $r = \sqrt{x}$
• Cube root (³J)
If $r^3 = x$; $r = \sqrt[3]{x}$

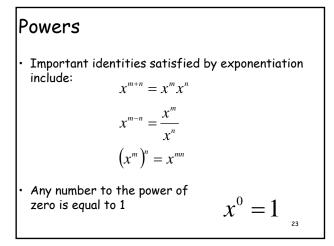
Roots • Expressing roots as powers $\sqrt{x} = x^{\frac{1}{2}} \sqrt[3]{x} = x^{\frac{1}{3}} \sqrt[4]{x} = x^{\frac{1}{4}}$ $\sqrt[y]{x} = x^{\frac{1}{y}}$ ₁₈

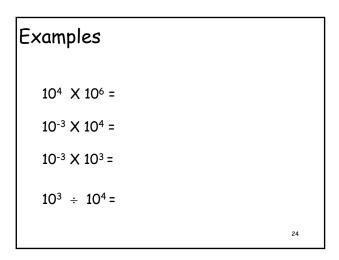


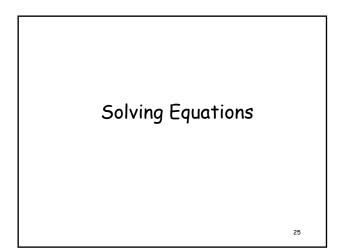












Solving Equations

- Equations are mathematical statements with two expressions separated by an equal sign.
- The expression on the left side of the equal sign has the same value as the expression on the right side.
- One or both of the expressions may contain variables.
- Solving an equation means manipulating the expressions to find the values of the variables.

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Solving Equations

- To keep both sides of an equation equal, we must do exactly the same thing to each side of the equation.
- If we multiply (or divide) one side by a quantity, we must multiply (or divide) the other side by that same quantity.
- If we add (or subtract) a quantity from one side, we must add (or subtract) that same quantity from the other side.

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Background Reading • FLAP Module M 1.1 • FLAP Module M 1.4 - Sections 1, 2

Solving Equations • Examples